

Climate Variability, Hydrology, and Flooding



Introduction to MODIS-based Inundation Mapping and GIS Applications



Objective

- To provide an overview of the MODIS Inundation Mapping Tool

Outline

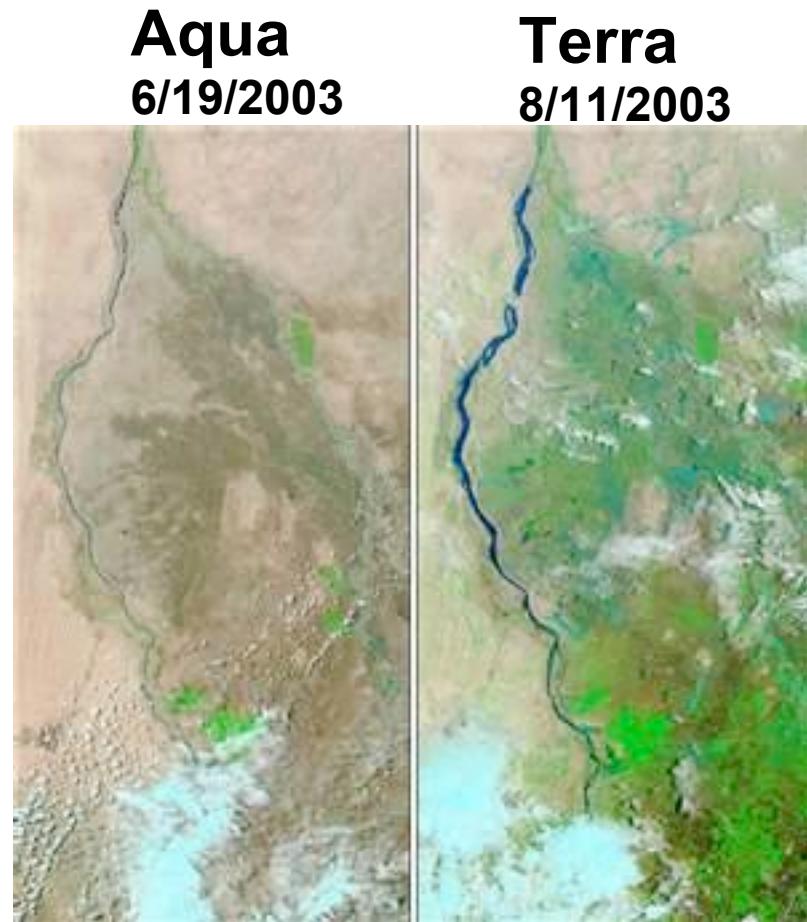
- About MODIS and the Inundation Mapping Concept
- *Near-Real Time Global MODIS Flood Mapping Tool*
- Importing MODIS Inundation Data in GIS

About MODIS and Inundation Mapping Concept

MODerate Resolution Imaging Spectroradiometer (MODIS)

<http://modis.gsfc.nasa.gov>

- Flying on-board Terra and Aqua – polar orbiting satellites
- Global measurements, 1 to 2 times per day
- 36 spectral bands observing atmosphere, ocean, and land properties
- Measurement footprints vary from **250 m to ~1 km**



Flooding along the White Nile, Sudan from the Natural Hazards page of earthobservatory.nasa.gov

MODIS Data for Inundation Mapping

MODIS Reflectance in Optical Bands 1, 2, and 7: (620-670 nm), (841-876 nm), and (2105-2155 nm)

- MODIS provides observations of land-surface. MODIS reflectance from these bands indicates the presence of water on land surface, previously not covered by water
- A global reference database of water bodies is formed – inundation is mapped with respect to the reference water

Spatial Resolution:

250m x 250m

Spatial Coverage:

Global

Temporal Resolution:

Daily, 8-day, 16-day

Temporal Coverage:

1998 to present

MODIS Data for Inundation Mapping

Strengths:

- High Resolution, Globally Consistent
- Can provide Coastal Inundation Mapping due to storm surge or tsunamis

Limitations:

- MODIS provides surface inundation mapping only outside the water bodies, it does not provide information about water depth or water flow
- It can not view the surface in the presence of clouds
- Mountain and cloud shadows may be erroneously interpreted as water inundated surfaces

MODIS-Based Interactive Flood Tools

- Near-Real Time Global MODIS Flood Mapping
- Dartmouth Flood Observatory (DFO)

Near-Real Time Global MODIS Flood Mapping Tool

MODIS Inundation Mapping

<http://oas.gsfc.nasa.gov/floodmap/>

NRT Global Flood Mapping

Global Map

View in ArcGIS Online map viewer.

Real-time feed of processed tiles available at: <modis.geobliki.com/modis/geoactivities.atom>

10° Flood Map Tile Production

For more information, please contact floodmap@lists.nasa.gov

News/Status

11-Nov-2014: ArcGIS Online Map avai
10-Nov-2014: MODIS flood product ev

10°x10°

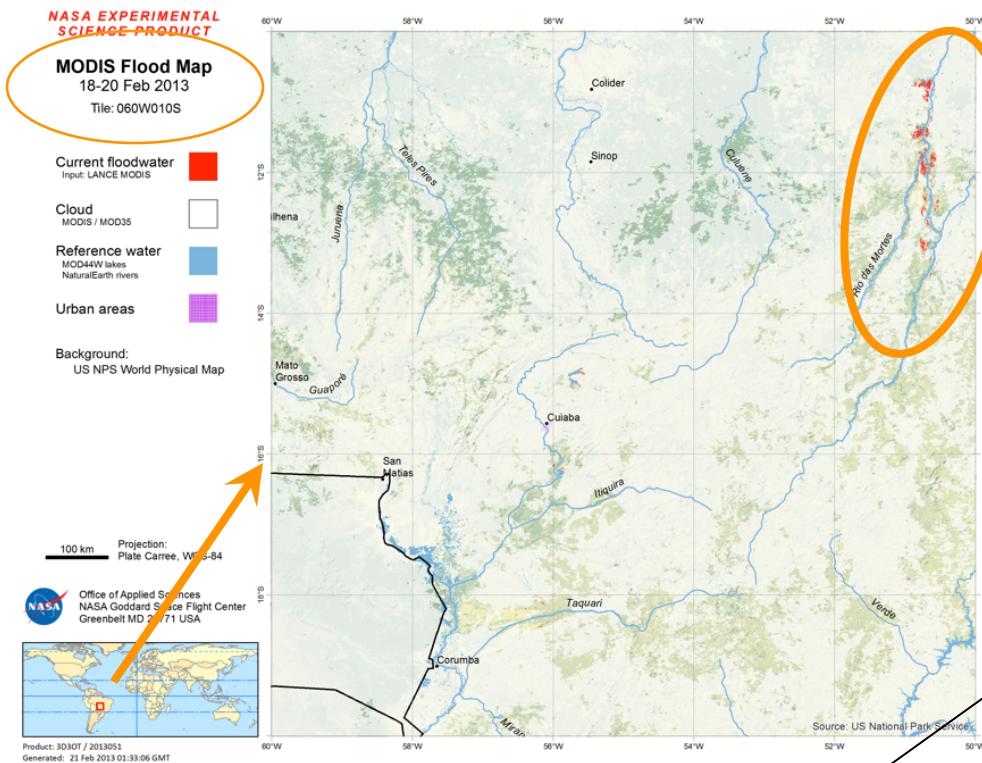
> Go to News/Status page

MODIS Inundation Mapping: Zoom on a region

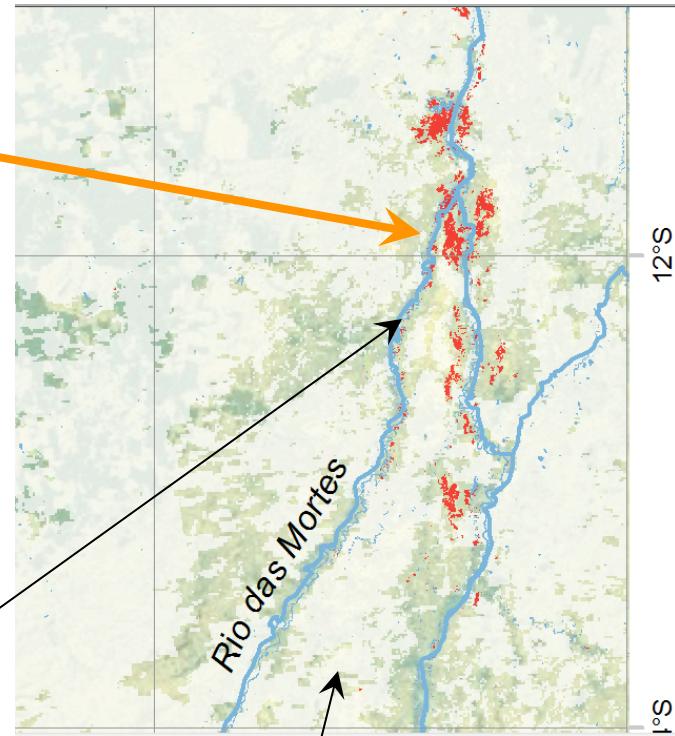
<http://oas.gsfc.nasa.gov/floodmap/>

Red Shading Shows Inundated Surface

Regional Mapping



Pixel size 250 m



Blue Shading Shows Reference Water

White Shading Shows Cloud Cover

MODIS Inundation Mapping

<http://oas.gsfc.nasa.gov/floodmap/>

PRODUCTS:

MFM: MODIS Flood Map = annotated 10x10 degree map/graphic product (currently available in png format).

MSW: MODIS Surface Water (Pixel classified with presence of water = Reference Water + Flood Water). This is based on a ratio of MODIS bands 1, 2, and 7 reflectance values.

Reference Water: based on MODIS reflectance and Shuttle Radar Topography Mission Water Body Data.

MFW: MODIS Flood Water – Obtained by subtracting Reference Water from MSW.

MWP: MODIS Water Product (Each pixel is assigned a number to identify as either undecided, water not detected, reference water detected, flood water detected where there is no reference water present)

MODIS Inundation Mapping

National Aeronautics and Space Administration

NRT Global Flood Mapping

Data Viewer

Product Description

Documents

Future Enhancements

News/Status

Mailing list
To subscribe to our mailing list to receive email

Archive Available since 2010

Composite Map

10-day Sequencing

png, kmz, geotiff images available

3 Day Composite 2 Day Composite 1 Day Composite 14 Day Composite

« April 2015 »

S	M	T	W	T	F	S
	1	2	3	4		
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Products

MODIS Flood Map	MFM	png
MODIS Flood Water	MFW	shapefile (.zip)
MODIS Surface Water	MSW	shapefile (.zip)
MODIS Water Product	MWP	geotiff
README	pdf	txt

Available Downloads

North (N) South (S) East (E) West (W)

Check slide show for the last 10 days.

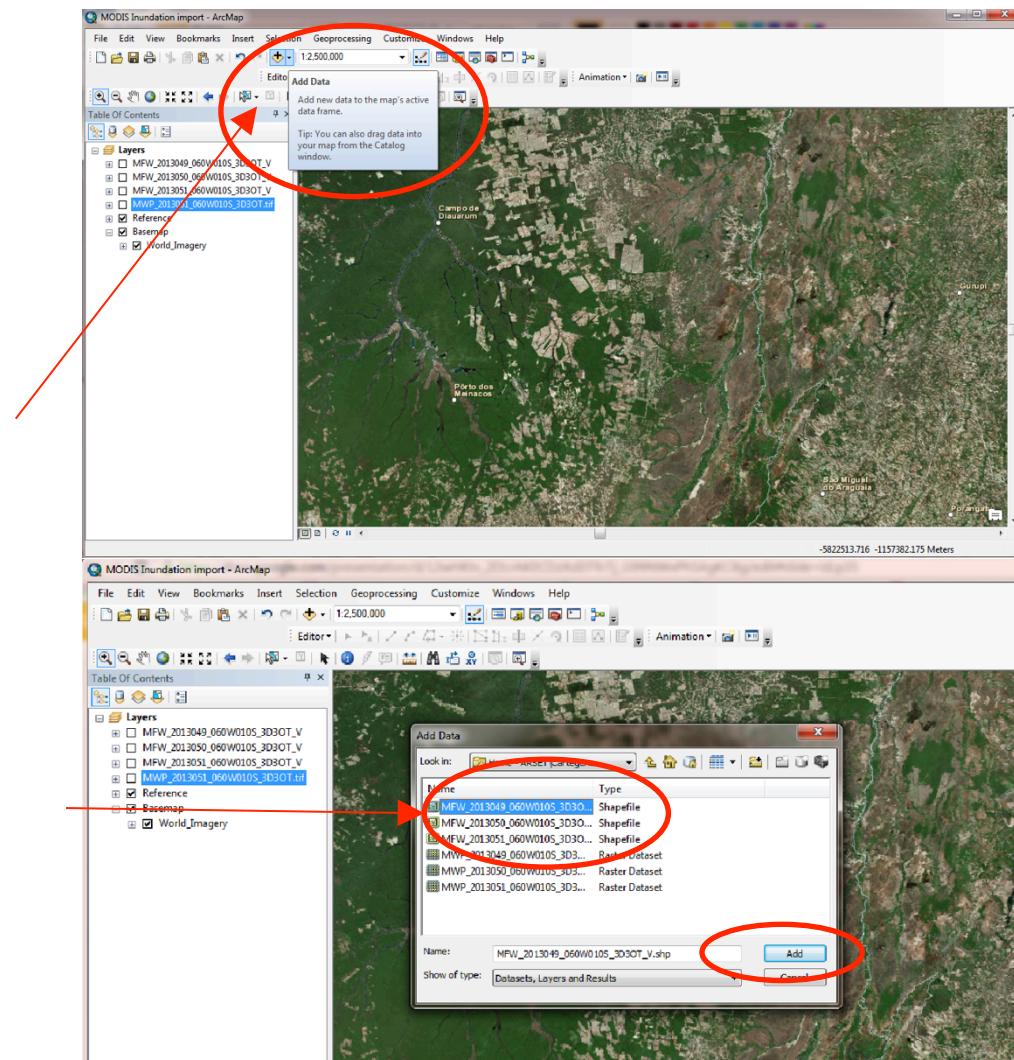
Importing MODIS Inundation Data in GIS

Display MODIS Inundation in ArcMap

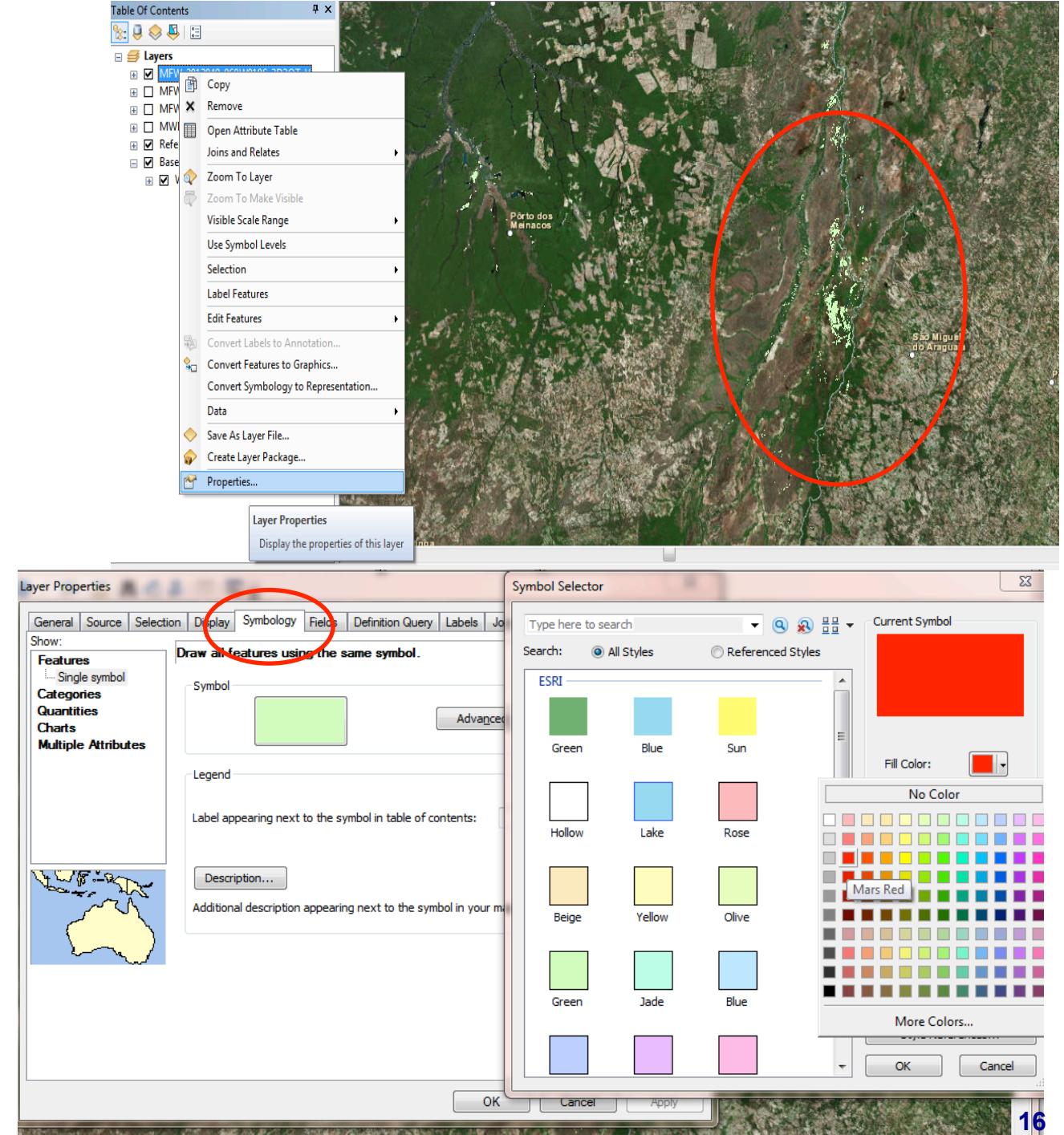
MFW shapefiles and MWP geotiff files can be easily imported into ArcMap.

Open the Add data icon and click Add Data

Select the MFW (MODIS Flood Water) shapefile or the MWP geotiff file and click Add.



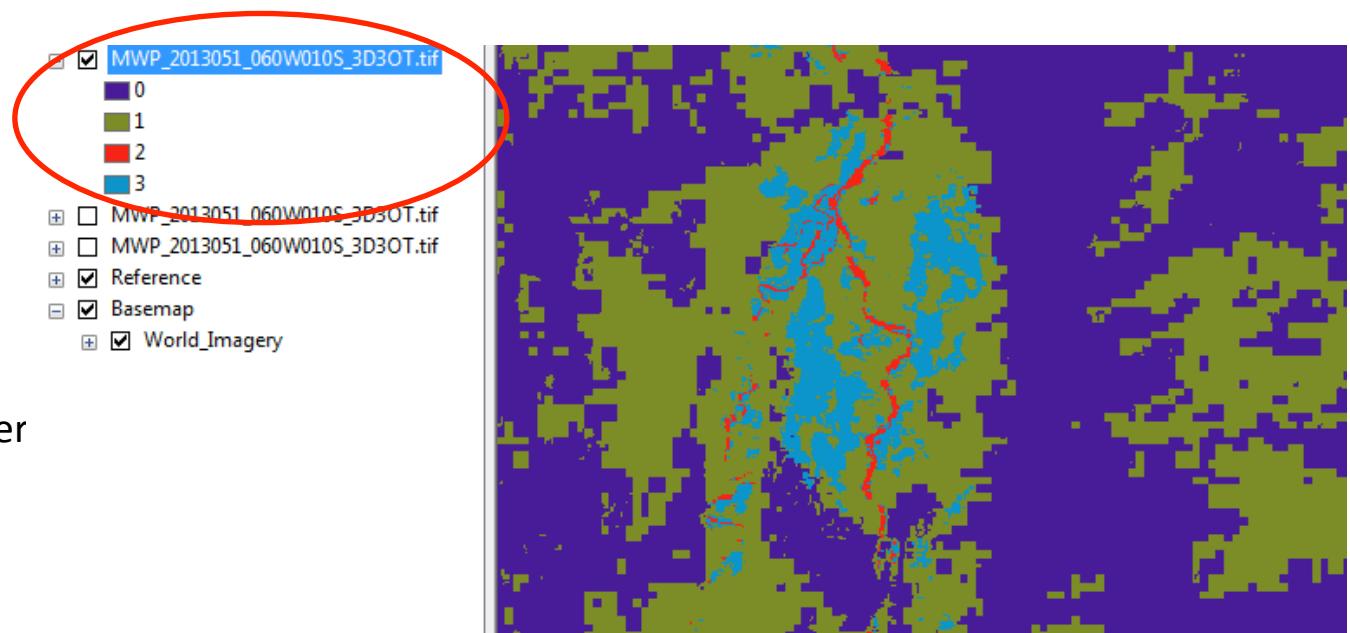
The shapefiles have been imported. You may wish to adjust the symbology color in order to visualize the inundated lands better.



Right click the layer, navigate to layer properties, Symbology tab, click the symbol color and choose the desired color. Click ok.

MWP: MODIS Water Product (geotiff file)

- 0 : Insufficient data to make water determination (cloudy, missing images, swath gaps swaths, or bad data values)
- 1 : No water detected
- 2 : Water detected AND coinciding with reference water (e.g., not flood)
- 3 : Water detected, beyond reference water, so is likely flood



You can adjust the symbology of the geotiff file through the layer properties, symbology tab. Within the Show window, choose Unique Values and alter the colors assigned to each pixel category.

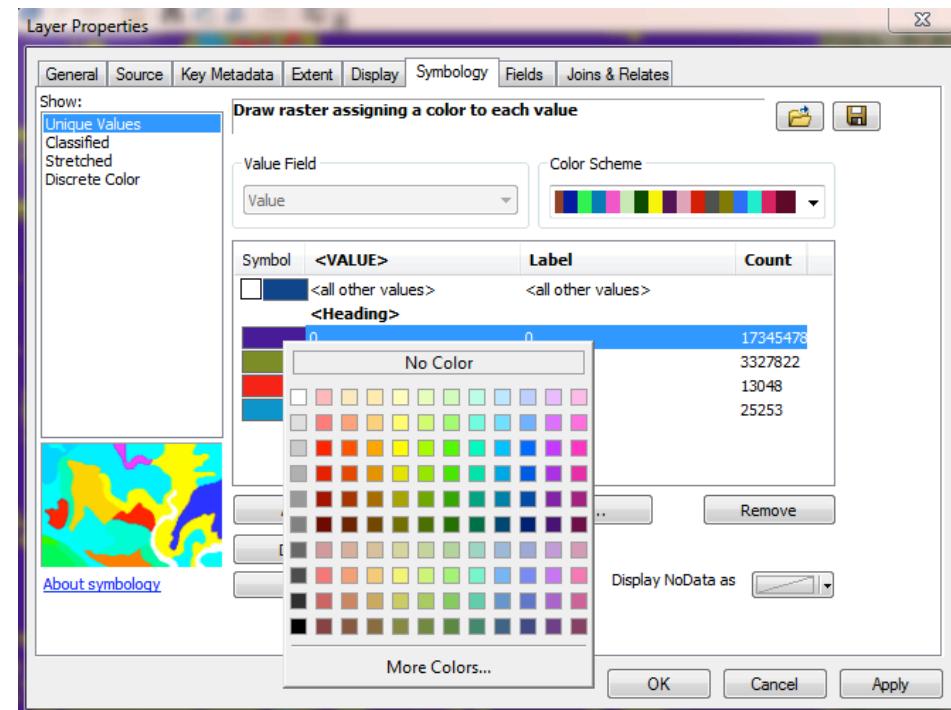
For example :

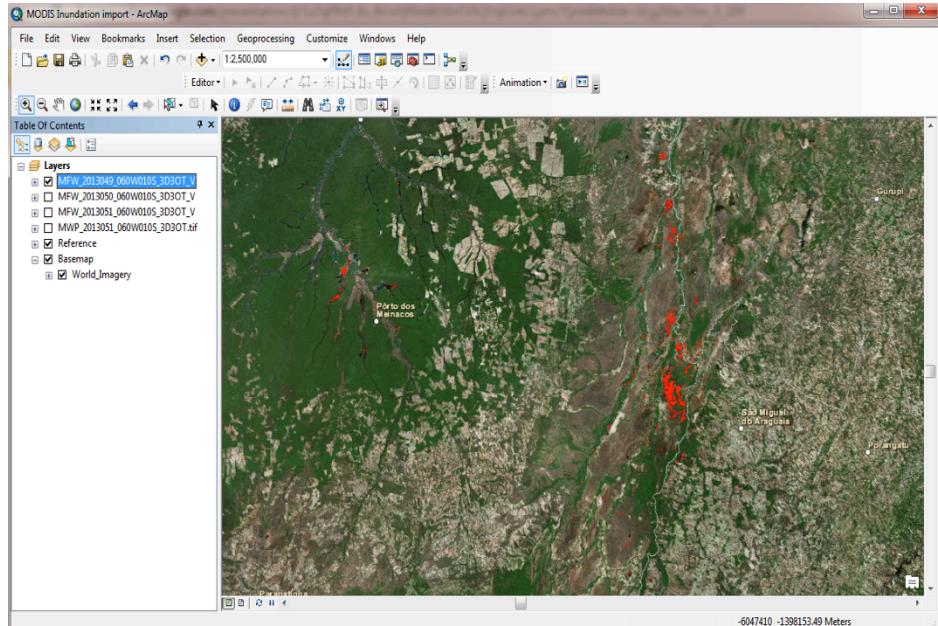
0=No color

1=No color

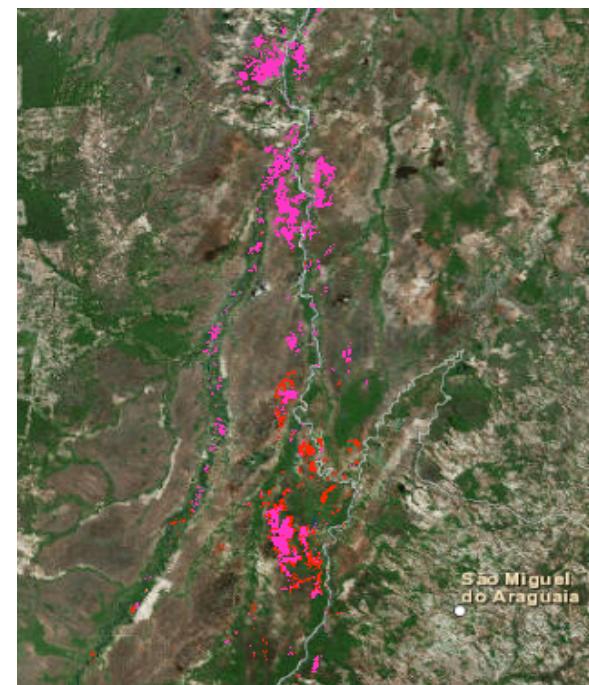
2=Blue

3=Red





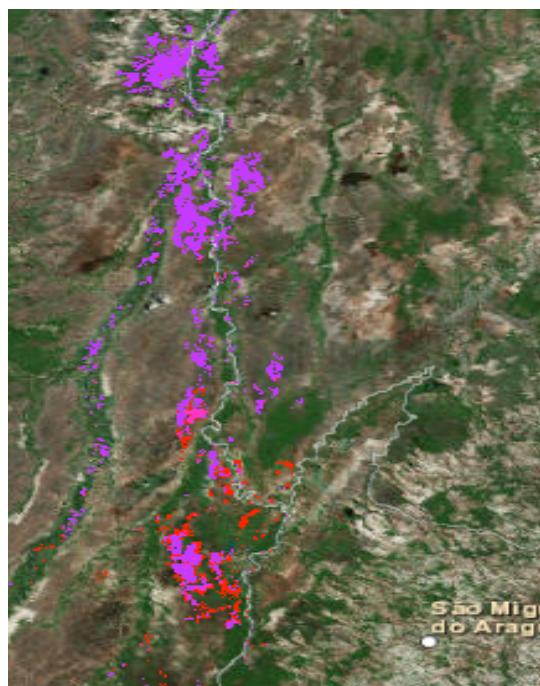
February 18, 2013



February 19, 2013

Repeat the process for all files for your chosen dates

Assigning different colors for each of the following dates can assist in visualizing inundated lands over time.



February 20, 2013



List of Common GIS Data Layers that can be combined with MODIS inundation layers for spatial analysis

Rivers/Basins	USGS HydroSHEDS	http://hydrosheds.cr.usgs.gov/
Population	NASA Socioeconomic Data and Applications Center (SEDAC)	http://sedac.ciesin.columbia.edu/
Elevation	NASA LP DAAC Consortium for Spatial Information (CGIAR-CSI)	https://lpdaac.usgs.gov http://srtm.cgiar.org/
Reservoirs	NASA Socioeconomic Data and Applications Center (SEDAC)	http://sedac.ciesin.columbia.edu/
Soil Type	ISRIC - World Soil Information	http://www.isric.org/
Dams	NASA Socioeconomic Data and Applications Center (SEDAC)	http://sedac.ciesin.columbia.edu/

Next Presentation will be on:

The Dartmouth Flood Observatory